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A Perspective of Researches on Neo-Logistics

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〈Abstract〉

This paper describes how studies at the Institute of Asian Pacific Studies for Multi-Clients, started in 1996, have gone beyond the boundary of 'production', to their present status. In addition, the issues on 'logistics' are suggested and new concepts of 'neo-logistics' are shown to be used as a solution for them.

The essential meaning of logistics is explained and the importance of the systems concept is emphasized which can be used as an objective for the logistics engineering.

1. Evolution from the studies of production to those of logistics

Since the Institute for Research in Productivity (IRP), the forerunner of the present institute, was founded at Waseda University in 1962, we have concerned primarily with production systems. Directly related to that was a project for developing a new production system entrusted to the Institute by Japan Machinery Federation (JMF) in 1987. From here, systematical studies that focussed on a production system for the next generation in our institute have begun. We have conducted various studies for the future of the manufacturing industries such as activities related to such an organization like the Japan Production and Inventory Control Society and studies entrusted by individual manufacturers. But, it was really from the project entrusted by JMF for three years that we began to realize clearly the development of a new production system [1].

Looking back and reading the reports written in those days, key terminology such as 'paradigm shift', 'borderless', 'information support', 'competitive advantages', 'flexibility', 'light and shadow, good and bad aspect of systemization', and 'human-oriented manufacturing 'were widely bandied about. And it can be said that these 'key terms' were clear signs that our efforts for solving current problems had perhaps already started. Coincidentally, this was also the moment when the manufacturing industries in Japan began their rapid growth.

Although the study entrusted by JMF ended in 1990, to keep the momentum, a newly created organization, System Science Institute, was undertook a new project called 'Manufacturing 2001'. This was a research and development study for the next generation of manufacturing and was supported by related industries that had been called 'Multi-Client' system [2]. The title 2001 indicated an objective of realizing the development of production systems 10 years later.

Many people involved in overseas industries were taken aback by our rapid growth and visited us to find out about our research. Consequently, some of our studies were translated and published abroad. For the last three years, the main theme for the project 'Manufacturing 2001' has been a ripple effect of the introduction of small sized and distributed system, evaluations of CIM and human-oriented manufacturing systems.

The research and development project for the next-generation in manufacturing was extended for another three years in 1993. During this period, we labeled the activity as 'Manufacturing 2003'. In this period, rapid changes of production environments

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were brought by the continuing appreciation of the Yen, internationalization, environmental problems and market diversification [3].

In this new environment, in which the term 'autonomous and collaborate manufacturing' replaced 'small sized and distributed manufacturing', we began moving forward to the period when the concept of 'Integration' began to be discussed and stressed. One might say an 'integration' of the flow of materials on a practical basis had steadily been carried out. At this point, we mean by the 'integration' the reorganizing of various elements of activities involved in order to unite them and make them free from the conventional framework, rather than letting traditional productions and physical distributions continue working in separate area.

In 1996, we came to a conclusion that our research goal was not the development of an optimum system in a framework of simple manufacturing, but the development of the system of material flows from supply, productions, physical distributions, supports for use, to disposal/recycle. And it was necessary to grasp an in-depth overall perspective of the whole system including all the aspects above. At this point, we began to realize that we had come to a cross-road point in our studies at which we were incapable of handling those problems any more within a existing framework of manufacturing systems. Therefore, we organized 'a cooperative society for the study of neo-logistics' under the umbrella of our institute. The prefix, 'neo' was added to signify the dawning of new era in an age where the term 'logistics' seemed to have now been universally accepted.

We all know that the term 'logistics' when used militarily means 'a supply, distribution, and replacement of materials and personnel for armed forces'. Then, logistics was indispensable for carrying out military activities in the battlefields such as the supply of ammunition, foods and arms to the frontline. Later, the word 'logistics' found it way into the business world and became part of its jargon.

In 1961, Bowersox, D. T. of the United States described as follows [4]:

"Physical distribution and business logistics are considered synonymous and are freely interchanged. During the past decade, the term physical distribution has gained the widest acceptance in business practice and educational circles and throughout the general literature dealing with product and raw material flow management".

Judging from the above statement, the most likely explanation is that the term 'physical distribution' and 'logistics' were used interchangeably in their infancies. However, over time, the term 'logistics' became gradually accepted as having a wider range of meaning than just 'physical distribution'. Logistics has now developed to the extent that it indicates a systemization of the whole lifecycle of materials including disposal/ recycle.

Looking back at the history of the modernization of physical distribution in Japan, in the early days, elemental technologies, especially automated machines, were introduced to try to carry out the modernization. Since 1970, automatic machines, such as automated warehouse systems, AS/RS, automated sorting systems, and automated guided vehicles (AGV), have been introduced positively. As such, we were more willing to neglect the importance of the 'system' itself which includes those elements.

Consequently, arguments emerged for the reconsideration of element-technology-oriented systems toward the next age. In order to apply the systems for a future environment, a shift was stressed toward making a new start through a re-examination of the 'status quo'.

As a result, there was a wide demand for a system that supported an implementation of logistics, its systemization, design and evaluation methods, various types of element technologies, and examples of installation and so forth. Responding to those requirements, we decided that our next area of research in manufacturing to be these topics in April 1996.

2. Theoretical background of logistics development

The practice of integration (fusion)

If we turn our attention to and comprehend other fields in

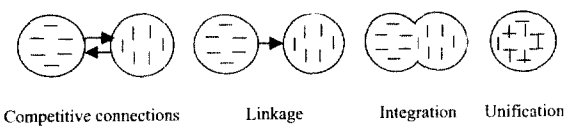
the surrounding environment during the operation of a system, we begin to create a larger system which invariably includes the present system. As time passes, people link the existing system to the external system and enlarge the systematized field. At the time when we comprehend another system, we soon realize that information gives impetus to this development. In the enlarged field, the original system dissipates the old borders, and fuses into the new system so that an optimum state for the whole is reached. This is the process of integration.

Taking a historical perspective, places where goods were produced long ago were characterized by the fact that people and tools were scattered about in no particular order. It was a chaotic world. Once upon a time, the system became comprised of the factors which would be gathered together and inter-related for creating a product. In such a manner, the production system was born, and eventually integrated with the system which distributes products to the surrounding people; production and physical distribution became united; the procurement of materials and consumption of products, and after-sales service supporting this activity, and disposal and recycling also became linked. Logistics moves to this direction.

In this paper, we will define a logistics system as follows:

"Focusing on the cycle of the overall flow of goods in a given environment--procurement, manufacturing, physical distribution, usage (consumption), and disposal and recycling--an integrated flow of goods and its support system which has been created with the aim of heightening the level of satisfaction of customer usage (consumption)". Logistics is therefore the technology which plans the integrated flow of goods and its supporting system as described here.

Integration is not simply a case of linking things together. It is characterized by the fact that the component tasks included within the linked process are reorganized. Competitive connections which were made through negotiations and bargaining create a stable integration, and result in the integration where the component tasks are reorganized. Figure 1 shows that process.



〈Figure 1〉 Changes in System Connections

The study of logistics attaches great importance to the integration as a keyword. In the following, an example of the integration of production and physical distribution is described:

Mass production for a market consuming standardized products began to thrive in the 1970s. In this period, a manufacturing entity absorbed a lot of goods-producing functions which had been decentralized around the towns up to that point, growing to colossal proportions. The making of shoes, the making of clothes, the making of bread and other jobs became centralized into large factories. As a result, manufacturing functions and distribution functions in all sectors became to be located in independent and isolated places. The cities in which people lived became sales centers, and products came to be manufactured in large factories located away in the suburbs. In this era, products were delivered to consumers through a physical distribution system.

Mechanized large-scale factories provided numerous advantages which people were able to enjoy. More recently, however, their limitations have started to come to the fore. People have begun to realize that the following changes have come about through centralized large-scale production.

1. Consumers' voices are not communicated to manufacturers.
2. Transportation takes time.
3. The system lacks flexibility.
4. No matter what you want to do, it takes time to get actions started.
5. People working in such systems have become unable to comprehend the structure of their system
6. It is difficult to achieve consistency among the targets of individual components within the system.
7. Increasing specialization has led to the loss of the sense of achievement for working people.
8. People have lost the will to work.

Companies have responded to this situation by making their factories smaller and more decentralized. This is the so-called "downsizing" process for factories.

Examples of downsized factories include mini-breweries, which flexibly supply boutique beers to the local market, small bakeries located on the premises of bread-shops, facilitating product freshness and flexibility, and urban-type factories (urban sewing factories) manufacturing make-to-order apparel with short lead times. These are unlike the small-scale, decentralized factories of a decade ago, because the new decentralized workplaces make the best use of the very latest technology. This process leads to the birth of strategic footholds in the consumer regions which combine both selling and manufacturing functions. Here, factories and physical distribution are reorganized and fused together.

The English word corresponding to the Japanese term "tougouka" is the "integration". We should note here its meaning: to eliminate distinctions. These days, the various activities related to the flow of goods in Japan, such as procurement, manufacturing physical distribution, consumption, and disposal and recycling, are undergoing a process of integration, which points to logistics.

Let us point out some examples of the integration which are being put into practice:

Assembling products in distribution warehouses.

- Baking bread in retail outlets.
- Brewing beer in restaurants.
- Mass sale stores developing private brands, and manufacturers making these products.
- POS information from the shop floor being directly transmitted to the manufacturer, and the manufacturer using this information to prepare his production plan.
- Supplying products to retailers under the just-in-time system.
- Making packaging materials on the filling line.
- Recognizing the capability of an external supplier to make quality components and supply them to the
- assembly line without inspection. Do it yourself.
- Consumers joining the assembly line to undertake the finishing work
- Consumers bringing their own recipes to the factory.
- Consumers sorting their garbage before putting it out to be collected.
- Developing products with priority given to the recycling of resources.
- Designing products with ease of dismantling taken into account.
- Developing intelligent machinery.

In all of these examples, we can conclude that there is an integration, reorganization and fusion of manufacturing and physical distribution, procurement and manufacturing, manufacturing and consumption, consumption and disposal, manufacturing and disposal, and information systems and equipment.

Management (planning and control) and the concomitant flow of goods are also integrated. The technologies which support the management and the flow of goods have a common content which we call the system design technology. It is not always easy to demarcate the principles of natural sciences and information technology used therein according to the sectors in which they are used. In the age of integration, it is difficult to use traditional terminology to interpret the system design. The phrase that is the fusion of management and technology also illustrates the same trend. It is now inconceivable for the management to dispense with the computer technology. The management and the computer technology are fused together. As a process of breaking down the framework of the old system and creating a framework for the new age, the fusion occurs in every sector.

3. Features of logistics organized

Before discussing 'neo', we will classify the features of logistics as follows [5]:

1) A co-possession of information

When a system is designed using the knowledge on the status of other systems, understanding them, and taking them into the consideration, the conventional framework of the system

gradually will collapse by themselves and will be reorganized to a higher system. As a result, the information becomes common in the range of the new framework.

Even if the range of activities is so wide as the one of logistics and those activities are distributed to a number of enterprises, a group of information will activate them as if they are a 'single enterprise'. This enterprise should be called as a 'virtual corporation'. To unify the entire system, a 'co-possession' of the information within the system is fundamental. Thus, this leads to the first step towards the 'Total Optimum'.

2) Life-cycle-oriented thinking

A life-cycle-oriented thinking in logistics implies that we attempt to predict dysfunctional outputs of the processes which constitute the whole materials flow from the gathering resources to their disposal. Environmental problems are also included here.

3) Regarding the importance of customer satisfaction

A system can not exist without consciously keeping in mind customers. For example, no one can deny such a fact that a customer of a pharmaceutical company is considered to be a doctor, or a customer of a supermarket is its shopper. In actuality, they are all partners of a supply chain for the real end customer, consumers.

By visualizing various activities of the chain, customers begin to realize the source of flow. And on the contrary, personnel in charge at the source become to be able to see end consumers.

The objective of a supply channel, then, is to be utilized by its customers to make materials flow. A target of the logistics is to regard the importance of customer satisfactions within the chain.

4) From a partial optimum to the total optimum

There certainly must have been a period of so called 'product out'. Therefore, they automated warehousing systems, tackled improving their layouts and introducing CAD. However, this does not help when poor selling products are made. It is, therefore, a matter of course that the total optimum of the material flow is required. So, when another enterprise starts handling a part of the flow, it becomes difficult to implement the principle, which thus far has been accepted as a matter of fact. Logistics then works as a tool to solve these problems theoretically.

5) Greater emphasis on a strategy that coordinates with management strategies

Logistics has a role as a management strategy and it is meaningful to handle it also as an objective of the logistics engineering.

6) Integration

The 'integration' does not mean a simple combination of systems. It is often characterized by the fact that a conventional framework disappears when the integration and the reorganization take place. In this way, it often appears that such phenomena as harmonizing of manufacturing and physical distribution results in no clear distinction between supplying and manufacturing. And, it becomes very difficult to differentiate between systems of information technologies and materials handling.

7) A chain of activities composed of individual enterprises

When one tries to handle a whole spectrum of materials flow, its activity inevitably appears more prolonged and more diversified. Therefore, in a real world of business, each company takes partial charge of activities in the flow. Thus, the formed entire body must behave in a controlled manner as if they were a single enterprise. This is what we call a 'virtual cooperation'. Alternatively, it would be summarized by a expression like 'independent enterprises working in synchronicity as a whole supply chain system, aiming at their customers' satisfaction.

4. Neo-logistics

As 'conventional logistics' make advances, the 'neo-logistics'

is now proving to be useful for the following purposes:

1) To put the system in order and establish methods and techniques to promote its way to 'logistics'. For example, to provide methods and techniques to share information in the system design, or to establish methods and techniques for a change from a 'partial optimum' to the 'total optimum and so on.

A systemized neo-logistics would not be realized, unless we provide a process to understand unsatisfactorily materialized characteristics of logistics and introduce methods to modify them.

2) To clarify methods of system constructions to complement its disadvantages when logistics process progresses.

One should complement, for example, the inflexibility of a system which can be found during the integration process with other systems. In this case, autonomous, distributed, small scaled, and cooperative systems and theories are to be requested.

It would be very important as well to establish a theory for the construction of a new system on which people can make an effort to develop a system by sharing information and helping each other. It is necessary not only to retain a fixed method of designing hardware like machines but also to make rooms for a new approach of flexible designing. Logistics, at this point, comes to have a nature of a 'social system' that embraces human beings.

3) To realize the characteristics described in the preceding section as an entirely new form

For example, we may have to build a multi-functional 'flexible shop' in which various processes of manufacturing are conducted, taking advantage of its global activities, and construct a flexible logistics system for a building construction site, from supplying raw materials and equipment to their withdrawal and clean up. Moreover, after the completion of the building, supply of daily commodities, and disposal of wastes may also have to be considered.

5. Some discussion on neo-logistics researches

Small-scale, decentralized, and autonomous collaborative systems which strengthen integrated and cooperative systems

In order to keep a system fresh, it is important that the people participating behave as if they are competing in a game. On the other hand, since the system collects, arranges, and inter-relates the components for various functions, movements of components are normally constrained by system's attempt to accomplish its functions. Integrated systems point to the systematization of the prior and subsequent processes, and of the flow overall. If logistics in a wider sense is interpreted only in terms of the keyword 'integration', even larger inflexible systems will be created in the future. In that case, the limitations of the centralized and large-scale systems described earlier will be carried unchanged into the future logistics. This will be no good whatsoever.

Meanwhile, cooperative systems have become a common topic of conversation. In particular, when the physical distribution costs account for a significant proportion of total costs, the cooperation in delivery and transportation emerges as a strategy to deal with the problem. This is an integration of common functions.

Company A and Company B were both in the storage business using one bay of a warehouse on an industrial estate. Initially, when both were unaware of the real circumstances, they built a partition between them so that each couldn't see what the other was doing. Before long, they noticed the similarities in the work they were doing. They then decided to work cooperatively. Next, they amalgamated to establish a new entity, Company AB. Other cases naturally utilizing cooperative processes are frequently observed. The Tokyo Be Marche Cooperative established in 1990 is a corporate cooperative delivery system which had previously operated as a textile goods wholesaler in Nihonbashi. The cooperative delivery system operated by Meiji Milk Products and Snow Brand in the Kansai District of Western Japan is also an example of the integration of systems which were formerly carried on independently by each company. Cooperation and

integration along the flow of goods is making rapid headway these days in the supply and recycling processes for goods and services.

Both integrated and cooperative systems which have grown from competitive links and unified links have the limitations of the large-scale systems cited earlier. In order to strengthen them, the strategy of operating the whole system as a collection of small-scale aggregations (companies) may be adopted. We should emphasize small-scale systems as practical examples of downsizing. Integration advances as an overall system and the factories therein are made smaller and physical locations decentralized.

The words by one of the organizers of the Asian Games held in Hiroshima at the start of 1995 come to mind here: "Japan can no longer play mass games." Each individual's awareness of his or her autonomy is heightening. Under the rules as they stand overall, it has become difficult to compel individuals to undertake highly constrained activities. That is the situation in Japan today.

Autonomous systems do not act in response to external commands, but gather their own information, think about how to undertake their own actions, alter their own structures when necessary, and learn and grow. Children are initially completely controlled by their mothers, and in due course, grow and become autonomous.

The logistics of the future will be constituted by small-scale aggregations. And it is preferable that the individual components be autonomous organizations. From the viewpoint of centralized systems, these are certainly difficult to manage. On account of their being centralized, instructions in integrated systems should be firmly driven from home to the furthermost units and the movement at these furthermost units should be visible. Trying to maintain the flexibility of such integrated (cooperative systems are also included) systems results in small scaled, decentralized, and autonomous systems.

Even though the unit may be autonomous, the wholeness must be maintained in some form or other. How should that required centripetal force be comprehended in a system? When charismatic managers have presided over a whole entity for a long period of time, the daily behaviors of those managers have an effect on the individual, give them some kind of direction, and frequently place invisible restrictions and limits on their way of thinking. The tendency continues even after that whole entity is split up to create small-scaled aggregations.

It is said that the collaboration is indispensable for bringing together autonomous individuals into a whole. Collaboration does not involve giving instructions. By constant negotiation and bargaining, we try to maintain the wholeness. To do so, negotiating and bargaining tools are required. The necessary tools are found in multimedia, a common topic of conversation these days. Of course, the telephone and facsimile are effective means. However, electronic mail, the Internet and other information networks are becoming actively utilized for more constructive negotiations. Professor Ishii says "The most easily adaptable organization for the coming age will be one in which the independent components of the organization play an active role, and moreover, collaborate as a whole entity. Such an organization can therefore be said to be a collaboration-type organization" [6].

The collaboration-type organization Ishii refers to is an autonomous, collaborative organization in which the technology of computer networks is employed. A new organization which recognizes individual autonomy and diversification will support the integrated logistics of the future. Companies as individual elements should be joined by links crossing their boundaries in trying to achieve the final optimization. And furthermore, whether or not they can have a global environmental and human-centered perspective through the overall lifecycle is another problem which we need to challenge for the logistics of the future. When you pay attentions to the field of 'neo-logistics', the limit of your endeavors could be boundless in both fields of practices and studies.

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